

**AMENDMENTS TO THE SPECIFICATION**

**In the Title of the Specification**

Please amend the title of the specification as follows:

TRANSMISSION ~~SIGNAL PRODUCTION~~ METHOD, COMMUNICATION METHOD, AND  
DATE STRUCTURE OF TRANSMISSION SIGNAL.

Please replace the paragraph beginning at page 1, line 5, with the following rewritten paragraph:

The present invention relates to a transmission ~~signal production~~ method, a communication method ~~using the transmission signal~~, and a data structure of the transmission signal and, more particularly, is advantageous to a multi-path environment such as that of mobile communication.

Please replace the paragraph beginning at page 4, line 4, with the following rewritten paragraph:

When transmission data is modulated via spread spectrum, a spreading sequence itself is processed in the prior art to make the periodic spectrum of a transmission signal a non-correlated spectrum. By contrast, when transmission data is modulated via spread spectrum according to the present invention, not the spreading sequence itself is processed as in the prior art but a ~~transmission~~ data sequence is processed to make the periodic spectrum of the transmission signal a non-correlated spectrum. Making the periodic spectrum of the transmission signal a non-correlated spectrum reduces an increase in the amplitude of a signal and reduces the dynamic range of an amplifier on the receiving side.

Please replace the paragraph beginning at page 4, line 21, with the following rewritten paragraph:

In a first mode of the transmission ~~signal production~~ method according to the present invention,

a plurality of finite-length signals of a length  $N_m$

$$S_{A,X}=(x_0A, 0\dots 0, x_1A, 0\dots 0, x_2A, 0\dots 0, \dots, x_{m-1}A, 0\dots 0)$$

$$S_{B,Y}=(y_0B, 0\dots 0, y_1B, 0\dots 0, y_2B, 0\dots 0, \dots, y_{m-1}B, 0\dots 0)$$

...

are created using a plurality of data sequences

$$A=(a_0a_1\dots a_{N-1}), B=(b_0b_1\dots b_{N-1}), \dots \text{ and}$$

a plurality of coefficient sequences

$$X=(x_0x_1\dots x_{m-1}), Y=(y_0y_1\dots y_{m-1}), \dots;$$

each finite-length signal of the finite-length signals  $S_{A,X}$ ,  $S_{B,Y}$ , ... is repeated to produce a pseudo periodic signal ...,  $S_{A,X}$ ,  $S_{A,X}$ ,  $S_{A,X}$  ..., ...,  $S_{B,Y}$ ,  $S_{B,Y}$ ,  $S_{B,Y}$ , ..., ...; and a part is cut out from this pseudo periodic signal to produce a signal of a predetermined length for making this signal a transmission signal ~~a coefficient sequence of a spreading sequence is sequentially shifted one pitch at a time, transmission data is multiplied by the plurality of coefficient sequences to produce a plurality of transmission data, and the plurality of produced transmission data are added up to produce a transmission data sequence. Alternatively, the coefficient sequence of the spreading sequence is multiplied by the transmission data, the result is sequentially shifted, one pitch at a time, to produce a plurality of transmission data, and the plurality of produced transmission data are added up to produce a transmission data sequence.~~

Please replace the paragraph beginning at page 5, line 3, with the following rewritten paragraph:

In a second mode of the transmission ~~signal production~~ method according to the present invention, ~~transmission data is multiplied by a coefficient sequence of a spreading sequence to produce a finite-length signal and this finite-length signal is repeated an infinite number of times to produce an infinite-length signal. Transmission data, which is longer than the coefficient sequence, is cut out from this infinite-length signal to produce a transmission data sequence~~ a plurality of signals of a predetermined length, cut out from the pseudo periodic signal produced from different finite-length signals, are added up to make the added-up signal to produce a transmission signal. In the first or second mode of transmission signal production described above, ~~transmission~~ a data sequence is included into the spreading sequence.

Please replace the paragraph beginning at page 5, line 14, with the following rewritten paragraph:

In another mode of the transmission ~~signal production~~ method according to the present invention, a plurality of transmission ~~data-sequences~~ signals are produced using different coefficient sequences when the first or second mode of the ~~transmission signal production method~~ described above is used for producing a transmission ~~data-sequence-signal~~ and, in an arbitrary combination of two different transmission ~~data-sequences~~ signals, a periodic cross-coefficient function of the transmission data of the transmission signals ~~data-sequences~~ is 0 for all shifts. The plurality of transmission ~~data-sequences~~ signals are transmitted in parallel so that the periodic spectrums of the transmission ~~data-sequences~~ signals have no correlation.

Please replace the paragraph beginning at page 6, line 24, with the following rewritten paragraph:

The communication method according to the present invention comprises the steps of transmitting the transmission ~~data-sequence~~ signal produced in accordance with the transmission ~~signal-production~~ method of the present invention and receiving ~~transmission~~ a data sequence via a matched filter corresponding to the coefficient sequence used for the production of the transmission ~~data-sequence~~ signal.

Please replace the paragraph beginning at page 6, line 31, with the following rewritten paragraph:

According to the communication method of the present invention, the transmission ~~data sequence~~ signal is used as a pilot signal for measuring multi-path characteristics, and the multi-path characteristics of a transmission path can be obtained by receiving this pilot signal.

Please replace the paragraph beginning at page 7, line 5, with the following rewritten paragraph:

In another mode of the communication method of the present invention, a plurality of transmission ~~data-sequences~~ signals are produced using different coefficient sequences and at least one transmission data sequence selected from the transmission ~~data-sequences~~ signals is used as the pilot signal with other transmission ~~data-sequences~~ signals used as transmission signals for transmitting information. The multi-path characteristics are obtained from the reception signal of the pilot signal, and the multi-path characteristics are removed from the reception signal of the other transmission signal signals using the multi-path characteristics, which are found, to produce transmission data.

Please replace the paragraph beginning at page 7, line 24, with the following rewritten paragraph:

The data structure of a transmission signal according to the present invention comprises a ~~transmission data sequence produced by cutting out transmission data, which is longer than the coefficient sequence, from an infinite-length signal produced by repeating a finite-length signal, produced by multiplying transmission data by the coefficient sequence of a spreading sequence, an infinite number of times~~ a signal of a predetermined length produced in accordance with a method comprising the steps of producing a plurality of finite-length signals of a length  $N_m$   $S_{A,X}=(x_0A, 0\dots 0, x_1A, 0\dots 0, x_2A, 0\dots 0, \dots, x_{m-1}A, 0\dots 0)$ ,  $S_{B,Y}=(y_0B, 0\dots 0, y_1B, 0\dots 0, y_2B, 0\dots 0, \dots, y_{m-1}B, 0\dots 0)$ , ... using a plurality of data sequences  $A=(a_0a_1\dots a_{N-1})$ ,  $B=(b_0b_1\dots b_{N-1})$ , ... and a plurality of coefficient sequences  $X=(x_0x_1\dots x_{m-1})$ ,  $Y=(y_0y_1\dots y_{m-1})$ , ...; repeating each finite-length signal of the finite-length signals  $S_{A,X}$ ,  $S_{B,Y}$ , ... to produce a pseudo periodic signal ...,  $S_{A,X}$ ,  $S_{A,X}$ ,  $S_{A,X}$  ..., ...,  $S_{B,Y}$ ,  $S_{B,Y}$ ,  $S_{B,Y}$ , ..., ...; and cutting out a part from this pseudo periodic signal.

Please replace the paragraph beginning at page 8, line 4, with the following rewritten paragraph:

FIG. 1 is a general diagram showing a transmission ~~signal production~~ method according to the present invention and the data structure of a transmission signal according to the present invention; FIG. 2 is a diagram showing the coefficients of a fourth order DFT matrix; FIG. 3 is a diagram showing the relation between a pilot signal and transmission signals; FIG. 4 is a diagram showing the relation and correlation between transmission signals and detected signals; and FIG. 5 is a diagram showing an example of a signal that uses a complete complementary sequence as the spreading code sequence.

Please replace the paragraph beginning at page 8, line 29, with the following rewritten paragraph:

According to the present invention, a transmission ~~data sequence~~ signal (shown in FIG. 1(c, d)) is produced from ~~transmission a~~ data sequence  $b (= (b_0, b_1, b_2, b_3, \dots, b_{M-1}))$  (shown in FIG. 1(a)) using a spreading sequence (sequence  $a = (a_0, a_1, \dots, a_{N-1})$  in FIG. 1(b)), and ~~this~~ ~~transmission data sequence~~ is used as a transmission signal. The length of the spreading sequence is  $N$  bits, and the data length of the ~~transmission~~ data sequence  $b$  is  $M$  bits.

Please replace the paragraph beginning at page 9, line 6, with the following rewritten paragraph:

To produce the transmission ~~data sequence~~ signal  $B$  from the ~~transmission~~ data sequence  $b$  ( $b_0, b_1, b_2, b_3, \dots, b_{M-1}$ ) (shown in FIG. 1(a)), the ~~transmission~~ data sequence ( $b_0, b_1, b_2, b_3, \dots, b_{M-1}$ ) is multiplied by the coefficients of the coefficient sequence ( $a_0, a_1, \dots, a_{N-1}$ ) of the predetermined spreading sequence (shown in FIG. 1(b)) to produce a plurality of transmission ~~data sequence~~ signals  $B_0, B_1, \dots, B_{M-1}$ .

Please replace the paragraph beginning at page 9, line 13, with the following rewritten paragraph:

FIG. 1 shows an example of the coefficient sequence ( $a_0, a_1, \dots, a_{N-1}$ ) of a spreading sequence, that is,  $(1, 0, \dots, 0, j, 0, \dots, 0, -1, 0, \dots, 0, -j, 0, \dots, 0)$ . When the coefficient sequence of this spreading sequence is applied to the ~~transmission~~ data sequence  $b$  ( $b_0, b_1, b_2, b_3, \dots, b_{M-1}$ ), transmission ~~data~~ signal  $B_0$  becomes  $(b_0, 0, \dots, 0, jb_0, 0, \dots, 0, -b_0, 0, \dots, 0, -jb_0, 0, \dots, 0)$  and transmission ~~data~~ signal  $B_1$  becomes  $(b_1, 0, \dots, 0, jb_1, 0, \dots, 0, -b_1, 0, \dots, 0, -jb_1, 0, \dots, 0)$ . The other transmission ~~data~~ signal is also processed in the same manner. The processing in which the ~~transmission~~ data sequence  $b$  ( $= (b_0, b_1, b_2, b_3, \dots, b_{N-1})$ ) is multiplied by the coefficients of the coefficient sequence ( $a_0, a_1, \dots, a_{N-1}$ ) of the predetermined spreading sequence is represented by

the Kronecker product as shown in FIG. 1(b).

Please replace the paragraph beginning at page 9, line 27, with the following rewritten paragraph:

Next, as shown in FIG. 1(c), a plurality of transmission ~~data~~ signals  $B_0, B_1, B_2, \dots$ , produced by multiplying them by the coefficients, are delayed each for one pitch and then added up to produce the data sequence  $B (= b + jb - b - jb)$ . In addition, data is added before and after this data sequence  $B$  to produce a finite-length periodic sequence. FIG. 1(d) shows a finite-length periodic sequence. As shown in FIG. 1(d), this finite-length periodic sequence is produced by adding the ending data sequence ( $jb$ ) of the data sequence  $B$  to the start of the data sequence  $B (= b + jb - b - jb)$  and by adding the starting data sequence ( $-jb$ ) of the data sequence  $B$  to the end of the data sequence  $B$ .

Please replace the paragraph beginning at page 10, line 17, with the following rewritten paragraph:

When the ~~transmission data~~ sequence is  $(1, 0, 0, 0)$  and the coefficient sequences  $(1, 1, 1, 1)$ ,  $(1, j, -1, -j)$ ,  $(1, -1, 1, -1)$ , and  $(1, -j, -1, j)$  of the rows of the DFT matrix are applied to the transmission data  $(1, 0, 0, 0)$ , the periodic sequences  $A - D$  can be represented by the Kronecker products as shown by expression (1) given below.

Please replace the paragraph beginning at page 11, line 30, with the following rewritten paragraph:

The transmission signal whose transmission data is the finite-length periodic sequence  $A'$  can be obtained by a matched filter (matched filter) corresponding to the coefficients of a spreading sequence used for the production of the transmission signal. A matched filter, a filter used for

de-spreading and obtaining the transmission ~~data~~ signal A, is produced corresponding to the coefficients of the spreading sequence used for the production of the transmission ~~data~~ signal A.

Please replace the paragraph beginning at page 19, line 20, with the following rewritten paragraph:

The transmission ~~signal-production~~ method, communication method, and the data structure of the transmission signal according to the present invention are advantageous to and ~~are~~ useful for the multi-path environment of mobile communication.